PATENT
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
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F. PERSSON	)	
	)	
Application No.: 09/857,348	)	Group Art Unit: 3679
	)	
Filed: July 24, 2001	)	Examiner: V. L. MACARTHUR
	)	
For: ROBOT DEVICE	)	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

DECLARATION UNDER 37 C.F.R. § 1.132

We, Fredrik Isaksson, Pierre Mikaelsson, Hakan Hvittfeldt and Jan Larsson, declare as follows:

1. I, Fredrik Persson, am a citizen of the Sweden and reside at Spejarvägen 9. S-722 40 Vasteras, Sweden. I am an inventor in the above-identified U.S. Patent Application.
2. I, Pierre Mikaelsson, am a citizen of the Sweden and reside at Helikoptergatan 19, S-723 48 Vasteras, Sweden. I am an inventor in the above-identified U.S. Patent Application.
3. I, Jan Larsson, am a citizen of the Sweden and reside at Adolf Zetheliusgata 11, S-724 78 Vasteras, Sweden. I am an inventor in the above-identified U.S. Patent Application.
4. We have reviewed the specification and claims of above-identified Application and references applied thereagainst, namely, U.S. Patent No. 4,976,582 to *Clavel* in view of U.S. Patent No. 2,733,085 to *Latzen*.
5. We do not believe that *Clavel* and *Latzen* render obvious independent claims 1 and 12, as well as new independent claim 17, as presently recited.

6. Based upon our experience and based upon the reasons stated below, we do not believe that the bearing means disclosed by *Latzen* could be utilized with an industrial robot, such as a Delta Robot, which has extremely rapid movements back and forth on the order of 0.5 seconds/stroke resulting in wear and requiring frequent replacement of the bearing element to prevent damage to the robot joints.
7. Specifically, the invention of independent claim 1 is an industrial robot including at least one linkage device in which pull rods are arranged in a multi-joint system where the joints include three-axle ball and socket joints. The ball and socket joints include a bearing element 3, which is fixed so as not to rotate in housing 2 of the socket joint. In order to increase the contact friction between surface 4 of housing 2 and bearing element 3, in one particular embodiment, bearing element 3 may be provided with friction-increasing means in the form of grooves 5' arranged substantially parallel with the central axis of the housing (see Figs. 3 and 4, page 3, lines 29-30 and page 4, lines 4-8). In the embodiment of bearing element 3 including grooves 5', these grooves on bearing element 3 may abut against surface 4 of housing 2, which also includes friction-increasing means in the form of complementary grooves engageable with the grooves provided on bearing element 3 to increase friction between surface 4 and bearing element 3 (see page 4, lines 4-8). Alternatively, if the bearing element 3 does not include grooves 5', surface 4 of housing 2 may nevertheless include friction-increasing means in the form of grooves engageable with bearing element 3 to increase friction between surface 4 and bearing element 3, (see embodiment of Figs. 1 and 2). The provision of the grooves on the surface of housing 2 prevents rotation of the bearing element in the housing since upon installation of the bearing element in the housing, the bearing element deforms to conform to the grooves in the housing. The grooves thus facilitate installation of the bearing element in the housing, and further facilitate removal from and replacement of the bearing element within the housing, as discussed in greater detail below.
8. The invention of independent claims 12 and 17 has been likewise recited, but claim 12 is directed to a method for eliminating risk of play in a three-axle ball and socket joint in an industrial robot, and claim 17 is directed to an industrial robot for which the socket is shaped as one-half of a sphere or less.

9. *Clavel* discloses a standard robot including ball and socket type joints. As acknowledged in the Office Action, *Clavel* does not disclose the ball and socket joints including a bearing and friction-increasing means.

10. *Latzen*, as illustrated in Fig. 1 thereof, discloses a conventional ball and socket joint including a bearing 7 having a circumferential knurled rim 15, (Col. 2: 10-13). As discussed in Col. 2:12-13 of *Latzen*, the provision of the knurled rim 15 on bearing 7 compensates for any eccentricity in the ball/socket connection, and ensures a good seat. As discussed in Col. 2:4-9, *Latzen* also indicates that "structural features of the ball and socket joint according to this invention are ball bearing means ... as well as different shaped grooves cut into the inner wall of the housing or the ball head 1." In the description following this statement, *Latzen* describes lubricating grooves 10 or 12 in ball head 1, but does not thereafter mention the "grooves cut into the inner wall of the housing," (see Col. 2: 10-39).

11. Contrary to the recitation in independent claim 1 of the present invention, whereas bearing 7 of *Latzen* includes a circumferential knurled rim 15, for the present invention, surface 4 of housing 2 includes friction-increasing means in the form of grooves engageable with bearing element 3 to increase friction between surface 4 and bearing element 3. Thus *Latzen* does not teach or fairly suggest, "the housing including a surface against which the bearing element abuts and the surface being provided with friction-increasing means in the form of grooves engageable with the bearing element to increase friction between the surface and the bearing element," as recited in independent claim 1, as amended.

12. Furthermore, whereas the bearing of *Latzen* is merely seated within housing 2, for the present invention, the bearing element actually deforms to conform to the grooves in the housing. Thus *Latzen* also does not teach or fairly suggest, "the grooves engaging the bearing element to deform the bearing element and thereby prevent rotation of the bearing element in the housing," as recited in independent claim 1, as amended.

13. We respectfully assert that the aforementioned distinctions between the present invention and the teachings of *Latzen* are significant, in that the provision of the grooves on the surface of housing 2 prevents rotation of the bearing element in the housing, since upon installation of the bearing element in the housing, the bearing element deforms to conform to the grooves in the housing. As also recited in independent claim 1, the grooves thus facilitate installation of

the bearing element in the housing, and further facilitate removal from and replacement of the bearing element within the housing.

14. We also respectfully note that whereas *Latzen* does indicate in Col. 2:4-9 that "structural features of the ball and socket joint according to this invention are ball bearing means ... as well as different shaped grooves cut into the inner wall of the housing or the ball head 1," these grooves mentioned by *Latzen* are merely lubricating grooves, such as grooves 10 or 12 in ball head 1. Thus based upon the teachings of Latzen, the "grooves cut into the inner wall of the housing" are only intended to be provided for lubrication purposes, and not for "engaging the bearing element to deform the bearing element and thereby prevent rotation of the bearing element in the housing," as recited in independent claim 1 of the present invention. Thus *Latzen* only teaches providing a knurled rim 15 for compensating any eccentricity (Col. 2: 10-13) and lubricating grooves, such as grooves 10 or 12 in ball head 1, and does not teach any "knurls" or "grooves" in the context of the present invention for engaging the bearing element, and thereby deforming the bearing element.

15. We further respectfully note that for the present invention, the provision of the grooves on the surface of the housing is not a mere inversion of the knurled rim 15 on bearing 7 of *Latzen* with knurls being provided on a surface of housing 2 of *Latzen*, since the grooves provided on the surface of housing 2 for the present invention are designed to serve the multiple functions of preventing rotation of the bearing element in the housing, deforming the bearing element upon installation, facilitating installation of the bearing element in the housing, and further facilitating removal from and replacement of the bearing element within the housing. For the present invention, installation, removal and replacement of the bearing element is enabled by simply pulling the bearing element in the direction of the central axis of the grooves in the housing surface (for removal), and attaching a new bearing element by pushing the bearing element in a direction opposite to the removal direction (for installation and replacement).

16. These noted benefits of providing grooves on the surface of housing 2 for the present invention are important because the present invention is directed to an industrial robot, such as a Delta Robot, which has extremely rapid movements back and forth on the order of 0.5 seconds/stroke resulting in wear and requiring frequent replacement of the bearing element to

prevent damage to the robot joints, (see description page 2, lines 14-16). In such industrial robots, a bearing 7 including knurled rims 15, as disclosed by *Latzen*, could not be adequately and economically used, since the bearing of *Latzen* would damage the housing of such a robot joint due to the knurled rims 15. During subsequent replacement of the bearing, the damaged housing would further lose its bearing retention capabilities due to damage by the knurled rims. Thus the bearing of *Latzen* could not be used with industrial robots, which is what the ball/socket joint according to the present invention is directed to.

17. We also respectfully note that the present invention has been realized by the me and the co-inventors due to the need for frequent replacement of the bearing element to prevent damage to the robot joints, and thus, as recited in independent claim 1, the invention recites an industrial robot joint for which, "the housing including a surface against which the bearing element abuts and the surface being provided with friction-increasing means in the form of grooves engageable with the bearing element to increase friction between the surface and the bearing element, the grooves in the housing surface being arranged parallel with a central axis of the housing, the grooves engaging the bearing element to deform the bearing element."
18. These features recited in independent claim 1 are therefore neither taught nor fairly suggested by *Clavel* and *Latzen*.
19. With regard to new independent claim 17, we respectfully assert that *Clavel* and *Latzen* do not teach or fairly suggest an industrial robot including, "at least one linkage device in which pull rods are arranged in a multi-joint system where the joints include three-axle ball and socket joints, wherein a bearing element is fixed so that the bearing element does not rotate in a housing in the socket of a joint, the housing including a surface against which the bearing element abuts and the surface being provided with friction-increasing means engageable with the bearing element to increase friction between the surface and the bearing element, the friction-increasing means being configured to facilitate installation of the bearing element in the housing, the socket being shaped as one-half of a sphere or less so as to facilitate rapid pivotal movement of the linkage relative to the socket, the one-half of a sphere shape of the socket further facilitating removal from and replacement of the bearing

element within the housing by enabling rapid disconnection of said ball and socket joint," as recited in new independent claim 17.

20. In addition to the features recited for independent claim 1, with regard to claim 17, the provision of the friction-increasing means on the surface of housing 2 prevents rotation of the bearing element in the housing since upon installation of the bearing element in the housing, the bearing element deforms to conform to the friction-increasing means in the housing. The friction-increasing means thus facilitate installation of the bearing element in the housing, and further facilitate removal from and replacement of the bearing element within the housing, as discussed in greater detail below. Additionally, as illustrated in Figs. 1-4 and discussed on page 3, lines 14-17 of the original specification, socket 1 is shaped as one-half of a sphere or less so as to facilitate rapid pivotal movement of the robot linkage relative to the socket. Due to the "one-half of a sphere" shape of the socket, the ball and socket assembly for the industrial robot of the present invention is required to be held together by the provision of a spring biased connection. The spring biased connection thus facilitates removal and replacement of the bearing element from the housing by a simple removal of the spring force and disconnection of the ball and socket joint.
21. As noted above, *Clavel* discloses a standard robot including ball and socket type joints. *Clavel* however does not disclose the ball and socket joints including a bearing, friction-increasing means or a socket having a "one-half of a sphere" shape.
22. *Latzen*, as illustrated in Fig. 1 thereof, discloses a conventional ball and socket joint including a bearing 7 having a circumferential knurled rim 15, (Col. 2: 10-13). As discussed in Col. 2:12-13, the provision of the knurled rim 15 on bearing 7 compensates for any eccentricity in the ball/socket connection, and ensures a good seat. Additionally, as illustrated in Figs. 1-4 of *Latzen*, the socket has a generally cylindrical shape.
23. Contrary to the teachings of *Clavel* and *Latzen*, as recited in independent claim 17, illustrated in Figs. 1-4 and discussed on page 3, lines 14-17 of the original specification, socket 1 is shaped as one-half of a sphere or less so as to facilitate rapid pivotal movement of the robot linkage relative to the socket. The provision of the "one-half of a sphere" shape is important for joint 1 because the socket/joint assembly of the present invention is directed to an industrial robot, such as a Delta Robot, which has extremely rapid movements back and forth

on the order of 0.5 seconds/stroke resulting in wear and requiring frequent replacement of the bearing element to prevent damage to the robot joints, (see description page 2, lines 14-16). In such industrial robots, the cylindrical joint disclosed by *Latzen* could not be adequately used since such a joint would prevent rapid movement of the robot links.

24. Furthermore, as noted above, due to the "one-half of a sphere" shape of the socket, the ball and socket assembly for the industrial robot of the present invention is held together by the provision of a spring biased connection. Thus without the spring biased connection, the ball/socket assembly would become disassembled. Based precisely on this feature, the spring biased connection thus facilitates removal and replacement of the bearing element from the housing by a simple removal of the spring force and disconnection of the ball and socket joint.
25. We respectfully note that the ball/socket assembly of *Latzen* provides none of the linkage assembly, disassembly or movement benefits listed above, and further provides none of the benefits of allowing a bearing element to be rapidly removed and replaced, as is virtually a constant necessity with such industrial robots.
26. Based at least upon the aforementioned distinctions, We respectfully assert that *Clavel* and *Latzen* clearly do not teach or fairly suggest "the friction-increasing means being configured to facilitate installation of the bearing element in the housing, the socket being shaped as one-half of a sphere or less so as to facilitate rapid pivotal movement of the linkage relative to the socket, the one-half of a sphere shape of the socket further facilitating removal from and replacement of the bearing element within the housing by enabling rapid disconnection of said ball and socket joint," as recited in independent claim 17.

27. We furthermore declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Date: 2004-09-13

Fredrik Isaksson

Fredrik Isaksson

Date: 2004-09-10

Pierre Mikaelsson

Date: 2004-09-12

Jan Larsson

Jan Larsson

Swedish Tax Agency

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EXTRACT OF THE POPULATION REGISTER

Date
2004-09-14

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Citizen of	Sweden
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Name as single	Persson
Place of birth (residence)	Vaksala
County	Uppsala
Sex	Male

END OF EXTRACT

* Indicates middlename